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12-8-95

THE DEPARTMENT OF ENERGY'S NUCLEAR WASTE CLEANUP: THE FIRST FIVE YEARS, 1989-1994[1]

Hanford: Trouble Getting the Show on the Road

I. INTRODUCTION

By the end of 1994, the five-year mark of the cleanup of the United States' nuclear weapons complex, the Department of Energy's (DOE) Hanford site in southeastern Washington state was frequently cited by politicians and the press as a symbol of government failure on a spectacular scale. Once the biggest star in the US' nuclear weapons constellation, Hanford was now castigated for what seemed a stunning display of wasteful spending. In the first five years of the cleanup, the government-owned, contractor-operated (GOCO) site had spent $5.4 billion[2] and had accomplished little cleanup of its radioactive waste. Ninety-two percent of the Hanford budget funded "overhead," according to a report of the General Accounting Office (GAO).[3] "Hanford shows what happens when an awesome environmental threat gets linked to pork-barrel politics," wrote a Wall Street Journal reporter.[4] Even Thomas Grumbly, the Department of Energy's (DOE) Assistant Secretary for Environmental Management, stated publicly in 1994 that he thought Hanford—the site of the largest DOE cleanup—wasted $1 of every $3 it spent.[5]

A key target of this censure was the DOE Richland Operations Office (DOE-RL), the DOE field office in charge of the Hanford complex. While admitting that Hanford had not done all it could to rein in costs in the first five years of the cleanup, DOE-RL managers—struggling with a vast assortment of bureaucratic and political obstacles to cleaning up the site—found the barrage of criticism exasperating. Even though little radioactive waste had been cleaned up, DOE-RL Site Manager John Wagoner and his senior administrative staff believed they had accomplished a number of important things. More than 40 percent of the site—albeit areas with very little contamination—had been cleaned up and released for public use. A tank containing high-level radioactive waste, considered unstable and at risk of explosion, was stabilized. And Hanford workers designed and built waste water treatment facilities in order to halt the discharge of billions of gallons of waste water into the ground each year—a practice that had enlarged an underground plume that environmentalists

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1 Within DOE, there is some disagreement as to when the cleanup actually began. In 1989, Energy Secretary James Watkins announced that the agency's primary mission would no longer be the production of nuclear weapons, but the cleanup of the weapons complex.

2 Officials at Hanford argue that this figure is misleading, as a number of non-cleanup operational expenses were included in the so-called "cleanup budget."

3 *New York Times*, June 21, 1993.

4 *Wall Street Journal*, March 28, 1995.

5 *Wall Street Journal*, March 28, 1995.

This case was written by Pamela Varley for Mark Moore, Guggenheim Professor of Criminal Justice Policy and Management at the Kennedy School of Government, and Malcolm A. Weiss, Program Manager of the Massachusetts Institute of Technology Energy Laboratory. Funding for the case was provided by MIT in collaboration with the US Department of Energy. The Kennedy School takes sole responsibility for its content. (1295)

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feared would accelerate the movement of contaminants into the nearby Columbia River. DOE-RL had also forged workable relationships with federal and state environmental regulators; developed a credible, broadly representative mechanism for involving the public; crafted a blueprint for proceeding with the cleanup that had widespread backing in the state; and introduced productivity incentives into the contract between DOE and the largest of Hanford's private contractors, Westinghouse Hanford.

Some of DOE-RL's senior managers went so far as to claim that by the start of 1995, Hanford was poised to become the nation's nuclear cleanup model; other interested observers, less sanguine, predicted that DOE would find a way to negotiate and plan forever, but would never get down to cleaning up very much of the waste. Admittedly, there were a number of hurdles to progress: disagreements over what, technically, should be done with the waste; a credibility problem for both DOE-RL and its contractors born of past mistakes; an organizational culture at Hanford that assumed plentiful funding and stressed the avoidance of risk; the dispersion of authority between DOE and its environmental regulators; continuing power battles between DOE-RL and DOE Headquarters in Washington DC (DOE-HQ); and a system in which, all along the chain of command, the relative balance of incentives and disincentives seemed to favor delay rather than progress. As an added complication, by early 1995, it seemed clear that—before even getting to the expensive parts of the cleanup—the US Congress was going to slash the cleanup budget at Hanford and throughout the old weapons complex.

II. HISTORICAL CONTEXT OF THE CLEANUP

II.A. Thumbnail sketch of Hanford

The US Army Corps of Engineers initially acquired the Hanford site—a 560-square-mile expanse of desert—in 1943 as one of three satellites of the Manhattan Project, the secret national program to develop the atomic bomb. This enormous site, half the size of the state of Rhode Island, was chosen for its relative sparsity of population and for the ready availability of water and electricity. (A 50-mile stretch of the Columbia River, the largest waterway west of the Mississippi, flowed across the northern and eastern sections of the site, and Washington's Grand Coulee Dam had just started producing power.) The world's first plutonium production reactor was built at Hanford and it produced the plutonium used in the five-ton "Fat Man" bomb, which the US dropped on Nagasaki on August 9, 1945.

During the succeeding four decades of the Cold War, from the late 1940s to the late 1980s, the US nuclear weapons complex, comprising 17 facilities in 13 states, produced more than four nuclear bombs a day, on average.[6] Hanford's principal role in this colossal undertaking was to make bomb-grade plutonium. Two thirds of the 100 metric tons of plutonium in the nation's arsenal of nuclear weapons—and one fourth of the plutonium ever produced anywhere in the world—were made at Hanford.

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6 *Los Angeles Times*, November 27, 1994.

During and after the Cold War, Hanford—like all the other sites in the nuclear weapons complex—was a government-owned, contractor-operated facility. The complex was administered by an agency that, from 1947 to 1975, was known as the Atomic Energy Commission (AEC); from 1975 to 1977, the Energy Research and Development Administration (ERDA); and from 1977 onward, the Department of Energy. It was operated by a succession of large private contractors, including DuFont, General Electric, Rockwell, and Westinghouse. In 1989, when DOE announced the start of the environmental cleanup, the site employed some 14,000 people, about 300 on the DOE-RL staff, headed by DOE-RL Manager Michael Lawrence. Most of the rest worked for one of Hanford's four largest private contractors. By far the largest of these was Westinghouse Hanford, which employed 9000 workers at the site.

II.B. The history of waste generation and waste management at Hanford

II.B.1. Making plutonium: a primer. Only a small amount of plutonium was necessary to make a nuclear warhead, but making that small amount of plutonium required a large amount of uranium. It also produced, in the process, an extraordinary volume of radioactive waste. The staggering waste and pollution problems that confronted DOE-RL at the start of the cleanup were partly the result of a messy production process and partly the result of four decades-worth of waste management practices later adjudged inadequate.

The process of turning uranium into plutonium at Hanford consisted of two essential operations. First, uranium metal, extracted from uranium ore and transported to the site, was irradiated in a reactor. The irradiated or "spent" fuel was briefly cooled in a pool of water and then ferried to a chemical separation or "reprocessing" plant. There, by way of a 30-step process, the spent fuel was dissolved in acid and the plutonium was separated from uranium and hundreds of radioactive byproducts, most notably cesium-137 and strontium-90. Before leaving the site, the plutonium was sent to a "finishing" plant, where it was fashioned into metal discs. It was then sent on to Rocky Flats, Colorado and elsewhere to be made into nuclear weapons. Hundreds of tons of spent fuel were necessary to yield the few pounds of plutonium required to make a bomb. Thus, ounce per ounce, plutonium was said to be the most expensive substance ever created.[7]

II.B.2. Generating waste. Hanford processed 100,000 metric tons of uranium during its years of operation, and generated several hundred thousand metric tons of chemicals and waste, including 60 million gallons of a highly radioactive substance known as *high level waste*, a toxic stew comprising short-lived but very radioactive fission products, long-lived radionuclides, hazardous chemicals, and heavy metals. By federal law, all high-level waste across the country was to be consolidated and packaged for eventual long-term storage at a single federal repository destined to be built at Yucca Mountain in Nevada.

The creation of plutonium at Hanford also generated large quantities of *transuranic waste*, any material—for example, chemicals, protective clothing, tools, piping, and air filters—contaminated by

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7 *Atomic Harvest: Hanford and the Lethal Toll of America's Nuclear Arsenal*, by Michael D'Antonio, Crown Publishers, Inc., New York, 1993, p. 16.

plutonium (or any other element with an atomic number higher than that of uranium). This waste was considered dangerous both because of plutonium's long-lived radioactivity (only half-gone after 24,000 years) and its high carcinogenic threat to human and animal life, particularly if inhaled as dust. What's more, plutonium was hard to store. Some forms of plutonium metal were known to spontaneously ignite when exposed to air above a certain temperature. And no more than a few kilograms of plutonium could be stored together without the danger of an inadvertent "criticality," or nuclear fission reaction. By federal law, transuranic waste from across the country was to be packaged and sent to the Waste Isolation Pilot Plant (WIPP), a federal repository located in a salt formation in southeastern New Mexico.

The production of plutonium at Hanford also created many hundreds of millions of gallons of *low level waste*, a catch-all label for radioactive waste that was neither high level nor transuranic. Usually such waste contained a relatively small amount of radioactivity in a large volume of material. During its peak years of operation, Hanford's most modern and productive reprocessing facility, the Purex plant, by itself discharged as many as 88,000 cubic meters of low level waste and condensation per day.

In addition to radioactive wastes, Hanford generated a large volume of *hazardous waste*—waste that was flammable, corrosive, toxic or reactive. Further complicating the picture was the large volume of *mixed waste*—waste that was both hazardous and radioactive.

The wastes generated at Hanford were no different than those generated elsewhere in the nuclear weapons complex, but because of the tremendous volume of plutonium produced at Hanford during the Cold War, and because of the production methods employed, fully two thirds of the high-level waste in the complex, by volume, was located at Hanford.

II.B.3. The history of waste management at Hanford. Though considered reasonable by most engineers at the time, the waste disposal methods employed between 1943 and 1970 at Hanford, and throughout the nuclear weapons complex, "would be considered primitive" by current standards, according to the DOE.[8] These early waste disposal techniques dramatically complicated the cleanup task confronting the DOE in the late 1980s.

II.B.3.a. Burying transuranic and low-level wastes. Until 1970, transuranic wastes—along with mixed wastes and low-level wastes—were buried directly in the soil or in perishable containers. After 1970, transuranic waste was segregated and buried in containers, with the idea that all transuranic waste from across the country would eventually be moved to WIPP. By the late 1980s, however, the repository was still in the planning stages and many of the transuranic waste containers were at the end of their useful lives.

The theory behind the early practice of dumping low level and transuranic wastes in the soil was that soil particles would trap the plutonium and low level radionuclides, and that it would take so long for the contaminants to make their way to ground water that they would be virtually harmless by

8 *Closing the Circle on the Splitting of the Atom: The Environmental Legacy of Nuclear Weapons Production in the United States and What the Department of Energy Is Doing About It*, a publication of the US Department of Energy, Office of Environmental Management, January 1995.

the time they arrived. These predictions would eventually prove faulty; radioactive wastes moved into the ground water faster than expected.

In addition, much of this early waste dumping at Hanford was casual: scientists at the site did not keep clear records of the location of these dumps, and the dumps themselves were often unmarked. To try to identify old dump sites, researchers even went so far as to round up older workers and retirees in the late 1980s. All in all, the Hanford workers were able to locate 300 major and 1100 minor dump sites where an estimated 440 billion gallons of chemical and radioactive waste—reportedly enough to fill a lake the size of Manhattan, 40 feet deep—had been discharged to the soil. Within that discharge was enough plutonium to build two dozen nuclear weapons.[9]

II.B.3.b. The high level waste and the saga of the tanks. Even given the standards of the day, Hanford's engineers knew from the beginning of their operations that they had to find a safe way to store the high level waste generated by Hanford's chemical reprocessing plants until someone figured out what to do with it. They settled on a strategy of neutralizing the acidic, radioactive waste with sodium hydroxide and then storing the mixture in underground, carbon steel tanks. In the 1940s, 100 steel tanks were built at Hanford. They were expected to last 20 to 25 years. Another 49 tanks were built in the fifties and early sixties. The smallest of the 149 tanks had a capacity of 55,000 gallons, and the largest, a million gallons.

But fuel reprocessing generated so much waste that the lack of adequate tank space became a chronic and nagging concern. The waste problem was further complicated when, in 1952, the engineers at Hanford began extracting uranium from the waste tanks.[10] This process created an even larger volume of waste, and added to its chemical complexity. To conserve tank space, yet more chemicals were added to the tanks to precipitate the radionuclides to the bottom so that a large volume of the waste could be siphoned off as low level waste, flowing from one tank to another, decanting off solids along the way, and finally winding up in unlined cribs, where the liquid percolated into the soil.

This approach distributed wastes from one tank to another and caused another problem. When cesium-137 and strontium-90 isotopes were consolidated, they generated so much heat that they caused the contents of some of the tanks to boil, which in turn caused cracking and bubbling in the floor of the tanks. Thus, in the 1960s, through another chemical process, the engineers extracted as much of the cesium and strontium from the waste as possible and isolated it in capsules, stored in a separate facility. Later, Hanford scientists discovered that they could increase the efficiency of the operation by adding ferrous cyanide to the tanks. Later still they learned that under certain conditions, ferrous cyanide was explosive.

The outcome of these various chemical processes, says Ron Izatt, DOE-RL's deputy manager, is "a mix of 149 single shell tanks with everything stirred around, different chemicals going in, jumping around, recycled, pumped out, and then heat pulled out—you end up with an absolute nightmare." No two tanks contained the same mix of ingredients. Even within a single tank, the waste had formed

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9 *Atomic Harvest*, p. 285.

10 In the first few years of operation, Hanford—focused on producing plutonium—had treated all the other constituents of the spent fuel, including the uranium, as waste. Uranium, however, was an expensive commodity as well as a potential security risk. Thus, the Atomic Energy Commission d cided to extract and recycle the uranium.

sedimentary layers that were quite different from each other in content and consistency. Some layers were hard salt cake, others gooey as honey. And no one knew how these various waste materials—boiled, vaporized, irradiated, and mixed over a span of decades—had interacted with one another. Izatt speculated that by the late 1980s, some of the tanks probably contained new chemical compounds "that nobody's ever seen before." As of the early 1990s, 54 tanks had been placed on a "watch list" due to worries about toxic vapors, ferrous cyanide, or explosive gases.

II.B.3.b.i. Leaking tanks. In 1956, Hanford workers detected a leak in one of the underground tanks. More leaks were discovered in the 1960s. What was worse, with the instrumentation available, it was not easy to tell when a tank was leaking until it had leaked a great deal. This was generally recognized as a bad state of affairs. If high level waste got into the soil, it would eventually get into the ground water, and if it got into the ground water, it would eventually get into the Columbia River. No one was certain how long this migration would take. In 1968, Hanford altered its tank design, building "double-shelled" steel tanks. This tank-within-a-tank design ensured that any leaks in the inside tank could be rapidly detected and repaired. Between 1968 and 1986, 28 of these double-shelled tanks were constructed. These tanks held 500,000 to a million gallons apiece and had a life expectancy of 50 years. Newly generated wastes could therefore be stored with some confidence. But what to do with the millions of gallons of high-level waste in the now-obsolete 149 single-shelled tanks? By 1973, 15 of the tanks had sprung "significant leaks into soil and ground water," according to the DOE. Most of the tanks had long outlived their original life expectancy; virtually all of them could be counted upon to leak eventually. The question, says one waste management engineer, "was not whether, but when" the leaks would occur.

To cope with this threat, waste management engineers at Hanford in the 1970s devised a plan to pump the liquid out of the single-shelled tanks and transfer it to the double-shelled tanks. If the single-shelled tanks could be limited to dry, hard waste, the danger of leaks would be much reduced, they reasoned. During the seventies and early eighties, however, this project remained a low priority for DOE, according to Rick Wojtasek, a waste management specialist for DOE-RL's chief contractor, Westinghouse Hanford. The effort did not receive much funding, and tank space for new wastes generated during the Reagan-era weapons buildup took precedence over transplanting the old wastes. Thus, in reality, the old single-shelled tanks were pumped only when there was strong evidence that they were leaking. "That's really not cleanup," says Wojtasek. "It's really crisis management."

By the end of the 1980s, 67 of the single-shelled tanks were known or suspected leakers, and an estimated one million gallons of high level waste had leached into the surrounding Hanford soil.

II.B.3.c. Hazardous and radioactive materials stuck in the pipeline. If Hanford's waste management history complicated the task of cleaning up the site, so, too, did the way Hanford's defense mission ended. Like much of the nuclear weapons complex, Hanford was subject to a series of contentious plant closures due to alleged safety and environmental blunders. DOE bitterly resisted these plant closures, and, when they finally came, they tended to be abrupt. The closures were also initially temporary; plants were expected to reopen once safety and environmental problems had been remedied. When the Soviet Union unilaterally dissolved and effectively ended the Cold War, however, many of these temporary closures became permanent ones. "They went from standby to

shutdown, in some cases overnight, without any consideration for the condition those plants were in," says James Mecca, DOE-RL's assistant manager for facilities transition. Thus, for instance, Hanford's Purex plant, a large reprocessing facility, ceased operation in midstream in 1989 due to safety violations, but was repaired, at an estimated cost of $500 million, in order to be prepared for the anticipated resumption of operations. Finally, in December 1992, Purex was officially shut down for good. Within the facility, in assorted processing lines and temporary containers were two metric tons of highly radioactive spent fuel, 200,000 gallons of uranium-contaminated nitric acid, and smaller amounts of plutonium nitrate, plutonium oxides and plutonium dust. Several other facilities at Hanford were shut down in similar fashion. The abrupt closures made for a situation that was at best awkward and expensive, and at worst, dangerous and unstable. Some highly radioactive materials were stranded in acid, for example, which was gradually destroying the containers that held it. Until they were cleaned up, the facilities had to be closely monitored and guarded for safety and security reasons, and this "baby-sitting" took tens of millions of dollars a year. Maintaining the Purex plant, alone, required 350 full-time personnel and cost $34 million per year.

In addition, the Plutonium Finishing Plant—where plutonium in liquid form was fashioned into discs for transport—was left holding some 3.8 metric tons of plutonium. The DOE was expected to recommend what to do with all of its store of plutonium in early 1996.

II.B.3.d. Spent fuel awaiting reprocessing. Another cleanup complication for Hanford concerned a large backlog of spent fuel—uranium metal that had gone through the irradiation phase but not yet through the chemical separation phase by 1988, when plutonium production at Hanford ceased. Over the years, a backlog of 2100 metric tons of spent fuel had accumulated in two large storage pools. These "K-Basins," located 400 yards from the Columbia River, had been constructed in the early 1950s with a 20-year life expectancy each and without modern earthquake resistance features. The East Basin held 3668 open canisters, each filled with seven "fuel rods"— metal-coated, irradiated uranium pieces weighing about 50 pounds each. The West Basin held 3818 canisters of fuel rods, but these canisters had been covered and sealed. The fuel rods had been fabricated with the idea that they could hold up for a few weeks, or perhaps even a few months, in the water-filled cooling basins, but certainly not for years on end. There had been no other obvious place to put the spent fuel, however, and so it remained in the basins. As a result, by the late 1980s, the metal coating on the outside of the fuel rods in the East Basin was corroding, and the surrounding water had become badly contaminated with radioactive uranium, plutonium, strontium, cesium and tritium. The basin also developed a leaking problem, and, by the late 1980s, had leaked millions of gallons into the ground.[11] The cost of "baby-sitting" the K-Basins—maintaining them as safely as possible under the circumstances—was about $40 million per year.

II.B.4. Recap of the major cleanup challenges

In sum, therefore, DOE-RL had to conceive and execute cleanup plans for the following:

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11 *Closing the Circle.*

- More than 60 million gallons of high-level waste stored in 177 underground tanks, 67 of which were probable leakers and 54 of which were on a "watch list" due to worries about explosive gases, toxic vapors, and excessive heat.
- More than 2100 metric tons of spent fuel, much of it corroding in an old, leaky, and badly contaminated water basin adjacent to the Columbia River.
- 100 facilities—most contaminated with radioactivity—that had to be decontaminated and decommissioned.
- 1400 sites of contaminated solid or liquid waste, 3 billion metric tons of contaminated soil, and 230 square miles of contaminated ground water.

II.C. The social and political history of Hanford

II.C.1. The "glory days". To the Cold Warriors designing and producing the bomb materials at Hanford, the imperative to win the nuclear arms race had been a heady mission and consuming passion. For the towns located closest to the Hanford site—the Tri-Cities of Richland, Kennewick, and Pasco—Hanford had long been a source of pride, patriotism and local prosperity. Between them, the DOE-RL and its private contractors employed about 25 percent of Tri City workers and—owing to high salaries—contributed 40 percent to the total Tri-City payroll.[12] Richland—the "company town" built by the federal government specifically for Hanford workers in the 1940s and 1950s—was the fourth most prosperous city in the state, just after some of Seattle's affluent eastern suburbs.[13] Richland had country clubs, fancy restaurants, its own orchestra, and a healthy dose of civic pride revolving around its identity as the "Atomic City," its nom de guerre. Many Richland establishments used the symbol of the atom in their logos or sported "atomic" in their names (as in the "Atomic Lanes" bowling alley). The Richland high school athletic jackets featured a mushroom cloud behind a large "R," and the embroidered slogan, "Nuke 'em." When the town was officially incorporated in the late 1950s, the town leaders even rigged up a mock atomic explosion to celebrate.[14]

Across the country during the 1970s and 1980s, public sentiment toward nuclear weapons and nuclear power took a precipitous downturn, due to the Viet Nam anti-war movement and a rising tide of safety concerns. But such worries were easily dismissed in the Tri-Cities where the allegations of danger were seen as a ploy to frighten a gullible public by activists who opposed nuclear weapons for political reasons. One of the area's local heroes, in fact, was Harold McClusky, a Hanford worker who became so radioactive after a plant explosion that he set off a Geiger counter at 50 feet, yet suffered no

12 *Tri-City Herald*, December 30, 1993. In the early 1990s, Hanford's salaries averaged $40-42,000, for example.
13 *Seattle Times*, April 26, 1994. (measured in buying income)
14 *Atomic Harvest*, p. 21.

apparent health problems. McClusky died ten years after the accident of heart disease at the age of 75.[15, 16]

Throughout the 1970s and early 1980s, the DOE-RL managers were, for the most part, unaffected by the hue and cry over nuclear weapons and nuclear safety. But in the mid 1980s, a series of developments pulled the Hanford site into the center of the fray. Perhaps most consequential among these was the fact that in 1986, the DOE announced that Hanford was one of three finalists to become the nation's repository for high-level radioactive waste. This was an idea welcomed by the Tri-Cities but regarded with fear and dismay by the rest of Washington state. Hanford's defenders insisted that the repository would pose no threat and that Hanford's work was now, and had always been, perfectly safe. Because Hanford had always operated under the veil of military secrecy, however, such assertions were impossible to confirm or dispute—until a group of Unitarian activists in Spokane filed a Freedom of Information request to make public many of DOE's classified records. In February 1986, some 20,000 pages of documents were released.

II.C.2. The 'Freedom of Information' revelations. For the first time, activists, journalists, and residents across the state learned how much radioactive waste had been discharged into the soil at Hanford. In addition, they discovered that in the early days of Hanford's operation, low level radioactive wastes had been released directly into the air and water in very large quantities, in keeping with the theory of the day—"dilution is the solution"—that the best thing to do with such wastes was to disperse them. For instance, Hanford's eight original nuclear reactors—adjacent to the Columbia River—drew water from the river for cooling purposes. In the process, the water became irradiated and was passed to retention bins for 30 minutes to six hours, giving only the shortest-lived radionuclides time to lose radioactivity before the water was dumped back into the river. During the mid sixties, Hanford's peak production years, the reactors took in 900,000 gallons per minute from the Columbia River and poured it back. By the early 1960s, radioactivity had been detected in river fish, and the dumping had gotten the attention of state health departments in both Oregon and Washington, as well as the US Public Health Service. In 1971, the last of the eight original reactors was shut down and the newer N-Reactor—which recycled cooling water internally—became the only active production reactor at Hanford.

More alarming to environmental activists, however, was the discovery that large quantities of radioactive iodine had been released into the air. Until the 1960s, air filtration equipment in Hanford's reprocessing plants was ineffective, and over time, these plants released an estimated 780,000 curies of Iodine-131, which landed on nearby farm crops and grazing areas, were ingested by dairy cows and entered the local milk supply—the greatest path of human exposure. I-131 tended to attach itself to the thyroid gland, causing cancer and other ailments. Karen Dorne Steele, a journalist from Spokane, provided eerie anecdotal evidence that residents in the area had suffered from these

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15 *Seattle Times*, November 9, 1993.

16 To their critics, Hanford workers became so comfortable working with radioactive materials that they were maddeningly blasé about its hazards. Insiders described an atmosphere in which workers who were sticklers about safety precautions were subject to the ridicule o. 'their peers. Indeed, some workers reportedly "cheated" on their dosimeters, which recorded their radiation expo>ure, in order to be allowed to work overtime in radioactive areas. (*Atomic Harvest*, p. 65.)

and other health problems. Through a series of interviews with farm families living downwind of Hanford, Steele reported what seemed an inordinate number of miscarriages, infant deaths, sterility, odd illnesses among children, respiratory complaints, chronic problems with skin sores, and premature deaths due to cancer and heart disease. She related a bizarre tale of dozens of lambs born dead or grotesquely deformed on a single night in 1961—a night one farmer christened "the night of the little demons."

The declassified documents indicated that scientists had been aware that the iodine emissions were potentially dangerous, but felt the national security imperatives warranted the risk. In fact, on December 2, 1949, while testing spy equipment designed to assess Soviet nuclear capability, Hanford scientists deliberately processed "green" uranium, releasing an estimated 11,000 curies of radioactive iodine into the air at once. (By comparison, the much-publicized Three Mile Island accident released between 15 and 17 curies altogether.) For anti-nuclear activists, this episode, called the Green Run, came to symbolize an arrogant callousness at Hanford about the environmental and health consequences of their military mission.[17]

The revelations were stunning to the activists who uncovered them. "The documents were far worse than we believed when we sought them," recalled Gerald Pollet, director of Heart of America Northwest. "These documents were very critical in opening the public's eyes about how bad the situation was at Hanford."[18] Based on the outcry over these findings, the DOE commissioned a "dose reconstruction" project in 1986 to try to assess how much radioactive iodine the local adults and children—about 100 times more susceptible than adults—had absorbed. Once this project was complete, the Center for Disease Control would undertake an epidemiological study of thyroid disorders in the area.

II.C.3. More bad press for Hanford. Throughout 1986, the bad news kept rolling in. On April 26, 1986, the Soviet Chernobyl reactor melted down, releasing 80 million curies of radiation and killing 250 people. The reactor had a number of design features in common with Hanford's own N-reactor, and when news of the similarities was publicized, citizen activists campaigned to shut down the reactor.[19] DOE-HQ appointed a panel of six experts to assess the reactor's safety. In December 1986, two of the six recommended permanent shutdown of the reactor. The other four recommended millions of dollars-worth of modifications. In response, the DOE-RL announced that it would shut down the N-reactor for six months to undertake a $70 million upgrade of the facility.

Meanwhile, that same year, an auditor for Hanford's chief contractor (at that time, the Rockwell Corporation) reported a series of serious safety problems at Hanford's Purex and PFP plants, including the unauthorized shipping and receiving of nuclear materials, improper control of plutonium (which could lead to a criticality), incomplete inventory of materials, and undocumented design changes in equipment (that might render emergency plans useless). When these findings were ignored

17 According to later calculations, contamination from the Green Run may have been significantly lower than initially thought, however. (International Herald Tribune, April 23, 1994.)

18 *The Business Journal of Portland*, December 20, 1993.

19 *Atomic Harvest*, pp 131-134. Some Hanford officials argued, at the time and years later, that the two reactors were actually quite dissimilar.

internally, the auditor, Casey Ruud, turned whistle blower and took them to the Seattle Times. In October, 1986—a few days after Ruud's findings hit the newsstands—the DOE-HQ ordered the temporary shutdown of the Purex and PFP plants.

Ironically, at about the same time, the DOE-RL office gave an overall semi-annual performance rating of "very good" to the Rockwell Corporation,[20] but a few months later, Rockwell—also facing grave charges of mismanagement at the Rocky Flats nuclear weapons site—lost its Hanford contract to the Westinghouse Corporation.

II.C.4. The end of weapons production at Hanford. The assorted revelations badly eroded the credibility of Hanford and the DOE-RL. In November 1986, the Washington state electorate voted 84 to 16 percent to oppose the location of a national waste repository at Hanford. But by this point, environmental and anti-nuclear activists were not content simply to keep additional nuclear waste away from Hanford. They wanted to see the complex shut down, and focused their efforts on keeping the N-reactor—closed for safety upgrades—from re-starting. A group called the Hanford Family, made up of boosters in the Tri-Cities, fought back, holding candlelight vigils, and tying yellow ribbons to tree branches to try to save their reactor. But—ultimately arguing that the US supply of plutonium was sufficient without the N-reactor—the DOE-HQ placed the N-reactor on "cold standby" in February 1988, and it was never started up again.

As of 1988, therefore, Hanford's primary mission shifted from weapons production to cleanup of the site, a dramatic change in goals and orientation. But the shift appeared more tentative and uncertain at the time, especially to those who did not want to believe it was true. Waste management and cleanup activities had always been of relatively low stature at the Hanford complex. A number of Hanford scientists hoped vainly for a new research or defense mission, and muttered disdainful comments about the cleanup project. "You can't overstate the demoralizing aspect of taking away high technology activities and asking us to become paper-pushers and janitors," one nuclear engineer, Mike Fox, told the Seattle Times.[21]

In fact, a symbolic battle over Richland's identity took place in 1988, when a school board member suggested that the mushroom cloud be removed from the Richland high school athletic jackets. The high school principal put the question to a vote, and students backed their bomb insignia by a resounding 1085 to 215.[22]

For those who wished to see it, however, the writing was on the wall—and it became clearer all the time. The beginning of the end of the Cold War came in 1989 with the fall of the Berlin Wall. That same year, President George Bush took office and appointed a retired navy admiral, James Watkins, as his Secretary of Energy. That year, Watkins announced a shift in emphasis at the DOE; the agency's primary mission would no longer be the production of nuclear weapons, but the environmental cleanup of the nuclear weapons complex. The dissolution of the Soviet Union followed in 1991, and the US announced that it would dismantle many of its nuclear weapons. In 1992, the US government decided to halt production of new nuclear warheads indefinitely. And a new billboard

20 *Los Angeles Times*, October 19, 1986.
21 *Seattle Times*, February 2, 1990.
22 *Atomic Harvest*, pp225-228.

appeared at the entrance of the Hanford site—a fuzzy photo of children picking wildflowers, along with the slogan, "It's the nature of our business."[23]

II.D. The ramifications of the larger political context

II.D.1. The centralization of DOE. Historically, the DOE field staffs—DOE-RL included—had paid little heed to their DOE compatriots in Washington DC. "DOE field offices were king. They would tell Headquarters pretty much what they were going to do and what they weren't going to do," says DOE-RL Deputy Manager Izatt. When Watkins was appointed to head the DOE, the agency had been buffeted for several years by scandals over allegedly unsafe and irresponsible operations at Hanford and other DOE sites. Watkins' brief was to get the DOE house in order. He moved swiftly to break up what he saw as the "fiefdoms" in the field, and to centralize authority at DOE Headquarters, increasing staffing for the headquarters office significantly.

II.D.2. Bringing on a new manager and reorganizing DOE-RL. In July 1990, the DOE-RL Manager, Michael Lawrence, a 21 year veteran of the DOE who had been site manager at Hanford for six years, announced his intention to resign and take a position in the private sector. That same month, stating that he was "not satisfied with management" at DOE-RL, Watkins appointed as Lawrence's successor John Wagoner, former deputy manager at the Savannah River Operations Office.[24] Wagoner—like Watkins, a veteran of the nuclear reactor program in the US Navy—had been detailed as a special assistant to Watkins for the several months prior to his appointment. Watkins also added two new deputy manager positions to the DOE-RL office and appointed DOE officials from other sites to fill them. (One of the new deputies was the director of a critical "Tiger Team" investigation of the Hanford site conducted by DOE Headquarters in the spring of 1990.)

Watkins also established a strict chain of command between DOE Headquarters and the DOE site offices. While the Richland office had in the past reported to DOE's Defense Programs office, it now reported to the newly created Office of Environmental Restoration and Waste Management (later shortened to Environmental Management), headed by DOE Assistant Energy Secretary Leo Duffy. Watkins established several broad cleanup programs in DOE-HQ's Environmental Management division, including Waste Management, Environmental Restoration, Facility Transition, and Technology Development. A mirror image of these programs was created at DOE-RL as well, and each was headed by a DOE-RL assistant manager. Each of these assistant managers sent his budget request up to the appropriate counterpart at Headquarters, in "stove pipe" fashion. The Headquarters staff reviewed the budgets in great detail, passing them along to Duffy with their own recommendations.

In the early 1990s, Congressional appropriations to DOE grew dramatically. Thus Hanford saw a sudden influx of funds. According to DOE-RL Deputy Manager Izatt, DOE-RL under the old regime had been a small, cohesive office of 300 with a manager and three deputies. (Critics argued, however, that the DOE was not doing a good job of managing its contractor. "The 300 people didn't know what the people out on the site were doing," says Dan Silver, assistant director of the state Department of

23 *Atomic Harvest*, p. 288.
24 Bureau of National Affairs Daily Report for Executives, July 12, 1990.

Ecology's waste management operation. "In the 'good old days,' people were kept in the dark and a lot of bad things were going on.") Under the new scheme, the office had a staff of nearly 600 with a manager and eight-member senior executive team. The change, says Izatt, "was good, because stuff had changed. Business the way you've always done it isn't the way you're going to do it. But boy, that was a tough mess for this office."

From the perspective of the DOE-RL managers who elected to stay, the new arrangement was a mixed bag. Some privately admired Watkins and were pleased to see an end to a dispiriting attitude of disinterest and neglect from Washington. "Under the Atomic Energy Commission, and under ERDA, there had been a demand for excellence, a sense of understanding why you are doing something," says Ken Bracken, DOE-RL's deputy assistant manager for tank waste. "Under the Department of Energy [established in 1977], that sense hadn't been there. Until Watkins came."

On the other hand, many DOE-RL managers found the Watkins era exasperating. Work at the site was increasingly held up by an involved and time-consuming approvals process in Washington. In addition, some DOE-RL managers felt the Washington staff was going overboard with its newfound authority, micro managing the activities of the site and firing off too many time-consuming demands for information and data.[25]

II.D.3. A sudden influx of funding. Nationwide, DOE's environmental management budget increased from $2.7 billion in fiscal year 1990 to $6.4 billion in fiscal year 1994 (in constant 1995 dollars). At Hanford, the environmental management budget increased from $500 million to $1.5 billion during the same period. Overall, staffing at Hanford increased from 14,000 to 18,000—more staffing for nuclear waste cleanup than had been employed to produce the nuclear weapons themselves. In fact, employment rose so quickly that Hanford suffered a shortage of office space. (Thus, for instance, the Tank Waste Remediation Systems Office was housed behind a row of small stores in what became known as the "BTF" building, for "Behind Tastee-Freez."[26]) The new employment spurred an economic boom in the Tri-Cities. Between 1989 and 1992, housing prices in the area rose 50 percent and employment rose 18 percent.[27] From the point of view of the local economy, the cleanup was suddenly seen as an economic bonanza—though some long-time Hanford employees predicted that the money would dry up long before the cleanup had been completed.

II.D.4. The new need to comply with environmental regulations. At the same time that its budget was increasing, however, DOE, as a whole, was losing an important measure of autonomy. For reasons of national security, DOE (and all its predecessor agencies) had traditionally enjoyed the authority to self-regulate in matters of waste management and environmental safety. Through a series

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25 Rick Martinez, a program manager for Hanford at DOE-HQ, says that administrators in headquarters were aware that their information demands could divert field personnel from more substantive activities, but he notes that senior managers in the headquarters office expected the program managers to be extremely well-informed. "When they ask a question, it's not of the contractor, it's not of the field office, it's of the program managers here. So we have to have a level of knowledge that's commensurate with the requirement of the management, and at times, that can be considerable. [If you're asked a question such as,] 'Why should we believe this budget estimate?' well, you're put in a position where you need to know not just *what* it is but *why* it is."

26 *New York Times*, June 21, 1993.

27 *Atomic Harvest*, p. 288.

of legislative, judicial, and administrative battles in the 1980s, however, DOE lost much of that authority.

In 1986, the US Congress amended CERCLA, the Comprehensive Environmental Response, Compensation and Liability Act, commonly known as Superfund, to include federal facilities explicitly within its purview. CERCLA, administered by the Environmental Protection Agency (EPA), required the cleanup of hazardous and radioactive dump sites generated by past, rather than ongoing, activities.

A more protracted argument raged over whether DOE was subject to the 1976 RCRA, Resource Conservation and Recovery Act. RCRA, administered by the EPA and EPA-authorized states, governed the treatment, storage, and disposal of wastes generated by ongoing activities. RCRA's purview explicitly excluded radioactive material. But in 1984, the State of Tennessee sued DOE and a federal judge ruled that RCRA did, in fact, have authority over DOE's non-radioactive waste. And in 1987, DOE-HQ formally accepted, for once and for all, that mixed waste was also subject to RCRA's authority.

This decision opened up virtually the entire Hanford cleanup to regulatory scrutiny and control, and represented a major defeat to the DOE-RL managers, who had fought hard during the early and mid 1980s to avoid having to comply with RCRA and with the directives of the Washington State Department of Ecology, which administered a state hazardous waste law and was delegated enforcement authority for RCRA in November 1987.

To the DOE, the final nail in the coffin came in 1992, when President Bush signed into law the Federal Facilities Compliance Act (FFCA) which gave environmental regulators the right to levy fines and penalties on federal agencies if they failed to comply with state or federal environmental laws.

II.D.5. Anxiety and confusion over environmental regulation. Although the DOE sites now had a mandate to "clean up" their wastes and to comply with CERCLA and RCRA—and although Hanford's senior managers knew the site was significantly out of compliance with both laws—no one had defined what constituted an acceptable level of environmental cleanup. Realistically speaking, Hanford's senior managers knew it was impossible to return the complex to the pristine desert scape of 1942—the so-called "green field" standard of complete environmental restoration that some environmentalists advocated. In their minds, a crucial question, then, concerned how clean, exactly, the regulators would require Hanford to be at the end of the cleanup, and how far they would require Hanford to go at each stage along the way.

In addition, the penalty for environmental noncompliance suddenly appeared quite high. In several highly publicized cases, the EPA had gone after environmental violators, both public and private, in dramatic fashion. Most alarming to managers at DOE-RL and Westinghouse, perhaps, was the June 1989 raid on DOE's Rocky Flats site, following a year-long investigation by the EPA and the Federal Bureau of Investigation (FBI). In that episode, about 90 EPA and FBI agents searched the site for 18 days, looking for evidence that the Rocky Flats contractor, Rockwell Corporation, had violated federal environmental laws. Ultimately, in a plea bargain, Rockwell admitted to five felony and five misdemeanor charges and agreed to pay an $18.5 million fine. The Rocky Flats debacle and other EPA

crackdowns gave many of the GOCO contractors across the DOE complex a deep and abiding fear of being indicted, says one Westinghouse manager.

DOE-RL managers were also apprehensive about how they would be treated by the EPA and the state Department of Ecology. The EPA had had no prior involvement with Hanford at all. For it's part, the Department of Ecology had had a miserably contentious relationship with DOE-RL throughout the 1980s. The state had repeatedly insisted that it had the responsibility to regulate mixed waste at Hanford. The DOE-RL, citing security issues, had refused to allow state inspectors even to visit the site, and the state regulators had come to regard Hanford as extraordinarily arrogant and high-handed. In addition, the Department of Ecology, along with the entire state government apparatus, had become involved in the fevered battle to prevent DOE from locating its national nuclear waste repository at Hanford. The bottom line, says DOE-RL Deputy Manager Izatt, is that "the regulators we inherited in 1988 were not happy with the Department of Energy—and not only the same regulators, the same *people*."

Adding to the confusion was the fact that, as commonly interpreted, CERCLA and RCRA embodied two different philosophies of environmental regulation, although, according to Randall Smith, director of the Hazardous Waste Division in Region 10 of the EPA, "it's possible to use them and manage them so their roughly equivalent." Broadly speaking, RCRA was stricter and less forgiving, requiring cleanup to established standards regardless of cost or inconvenience. CERCLA was more flexible, allowing for negotiations over cleanup levels depending on cost considerations, technical practicability, and intended future land use.

What's more, the division of responsibility and authority between RCRA and CERCLA, which made sense on paper, did not always make as much sense on the ground. For instance, two out of three side-by-side trenches might be under CERCLA authority while the other one was under RCRA authority, says DOE-RL Deputy Manager Izatt—with "one regulator was saying, 'Cover it over,' and the other regulator was saying, 'Dig it up.'"

II.E. Preparing for cleanup: A summary of the issues at hand

In sum, therefore, DOE-RL was expected to execute a major environmental cleanup despite widespread disagreement over what cleanup levels were adequate (or even possible) and what technologies were appropriate to the task, and despite the fact that no single government entity—not DOE Headquarters, not DOE-RL, not EPA, not the Washington State Department of Ecology—had clear authority to determine the answers to these questions. The two chief environmental laws governing the cleanup, CERCLA and RCRA, were enforced by different agencies. DOE-RL had no relationship with the EPA, the CERCLA-enforcer, and an extremely hostile relationship with the Washington State Department of Ecology, the RCRA-enforcer. In addition, morale at Hanford was generally low; much of the staff desperately hoped for a reprieve that would allow them to undertake defense research or return to producing weapons and would spare them from having to undertake the cleanup or to change longstanding ways of doing business.

Finally, DOE-RL had to navigate through this difficult terrain and cope with these myriad internal and external difficulties without allies or credibility. A number of high-level administrators at DOE Headquarters held the Hanford site in low esteem, and the site had a poor image in the local press and among the interested public.

III. DOE-RL AND THE HANFORD CLEANUP

III.A. Developing the Tri-Party Agreement.

Once Congress made it clear that CERCLA applied to federal agencies, in 1986, regulators from the northwest regional office of the EPA and the state Department of Ecology, and administrators from DOE-RL began to discuss how to approach the brave new world of environmental regulation at Hanford. The EPA urged Hanford Site Manager Michael Lawrence to apply to have the Hanford site placed on the National Priority List (NPL) under the Superfund program. Lawrence was quick to cooperate. "In my observation, a very small number of people saw the future, and Mike Lawrence was among them," reflects the EPA's Smith.

Meanwhile, in 1987, DOE-HQ ruled that the DOE complex was also subject to RCRA, and later that year, the EPA delegated enforcement of the law to the state Department of Ecology. Together, representatives of the DOE, EPA and Department of Ecology began feeling their way to establish a working relationship. As the Hanford site was out of compliance with both CERCLA and RCRA, the regulators and DOE had to craft some kind of "compliance agreement" which would obligate DOE-RL and its contractor to meet agreed-upon cleanup "milestones" within a prescribed time frame. One option was to craft two separate compliance agreements—one addressing CERCLA requirements and the other, RCRA. All the parties, however, quickly agreed that it would be far easier to operate under a single regulatory framework. For their part, the regulators wanted to avoid clashes with one another over jurisdiction. "From the very outset, we committed to each other that we were not going to view this as a question of dueling regulators, and so we set up a framework in the agreement that divided up the responsibility," says EPA's Smith. Some sections of the agreement were drawn up under CERCLA authority, some under RCRA authority. In areas of overlapping jurisdiction, the regulators agreed that either EPA or the Department of Ecology would be assigned the role of "lead regulator" and the other agency would plan a secondary role.[28]

Negotiation about the particulars of the Tri-Party Agreement continued through 1988 and reached a fever pitch at the end of the calendar year. The regulators were adamant that an agreement be signed before the change of administration in Washington DC in January 1989, as George Bush succeeded Ronald Reagan. Otherwise, they feared, the TPA negotiations would be set back as much as two years. The State of Washington threatened to sue DOE for failure to enter into a compliance agreement. In the end, the agreement was signed January 15, 1989 by the outgoing DOE administration. The document was formally called the Hanford Federal Facility Agreement and Consent Order, but was commonly known as the Tri-Party Agreement, or TPA. The agreement was not comprehensive; for

28 Even so, there was some regulatory confusion in these cases, and eventually, the regulators divided up the various "operable units" so that one or the other regulator had sole authority over cleanup activities . ere.

instance, when the parties could not agree on the fate of the single-shell tanks, they agreed to study the tanks further and make a later decision about them. But the TPA contained a schedule for accomplishing major pieces of the cleanup over a 30-year period. DOE-RL officials estimated that it would cost $57 billion to carry out the agreement.

The concept of creating a Tri-Party Agreement to govern the Hanford cleanup was widely embraced both inside and outside Washington State, but during the course of the next four years, all parties to the agreement, along with local and national environmental interest groups became dissatisfied with particulars of the accord or its implementation.

III.A.1. Concerns of the environmentalists. The battles of the 1980s to prevent Hanford from becoming a national waste repository and to keep the N Reactor from re-starting had left in their wake several environmentally-oriented civic groups that were skeptical of DOE-RL's competence and good faith in conducting the cleanup of Hanford. From the perspective of the environmental groups—including the Natural Resources Defense Council (NRDC) and the Spokane-based Hanford Education Action League (HEAL)—one of the biggest omissions from the TPA was its failure to address the fact that Hanford was still releasing millions of gallons of waste water from cleaning and processing functions directly into the soil. This practice created a large underground plume that accelerated the movement of more serious contaminants to the Columbia River, they charged.

These liquid waste discharges had been a "blind spot" of the regulators in negotiating the agreement; according to the EPA's Smith. "Both EPA and Ecology had their eye on other balls," he says—the EPA's on sites of past contamination and Ecology's on high-level tank waste and the intricacies of RCRA enforcement. "We got killed on it in public comment" of the TPA draft, Smith recalls. As a result, DOE-RL and the regulators wrote a side agreement in 1989 to study the matter.

The environmentalists had other concerns as well. The TPA called for removing the waste from the 28 double-shell tanks and treating it so as to separate high- from low-level waste. The high-level waste would be "vitrified," or made into glass logs, and sealed in stainless steel canisters. These canisters would eventually be transported off the site to the Yucca Mountain repository in Nevada. The low-level waste, however, was to be combined with "grout"—a mixture of cement, fly ash and clay—and buried shallowly on the Hanford site in 44 1.4 million gallon vaults. Environmentalists disliked this grout idea, favoring vitrification for both the high- and low-level wastes. Grout, they argued, would not hold up long enough to keep the soil and ground water safe from radioactive contamination. What's more, should environmental engineers come up with a better technological solution in future years, glass logs were retrievable; grout was not.

In addition, environmentalists were concerned about the fate of the single-shell tanks. Many Hanford engineers believed that for most of these tanks, the most sensible thing to do was to complete the task of siphoning off the liquids, leave them in place, and build an environmental barrier over the top of them. "By our estimate in 1988, for about $4 billion, you could reduce the risk significantly by leaving it in place," says Westinghouse's Rick Wojtasek. "Spending another $20 billion to retrieve and vitrify—you get very little risk reduction for that amount of money." Environmental activists, however, did not want the waste left in place— and their concerns about the tanks grew in the summer of 1990, when an advisory committee to Energy Secretary Watkins alleged that a number of Hanford's

single shell tanks posed a serious explosion risk, due to the presence of ferrous cyanide or flammable gases. One tank, in particular, was quite dangerous as it built up, and periodically "burped," a large quantity of flammable hydrogen gas, the study claimed. What was worse, the report continued, the hazardous burping had been going on for 13 years with no remedial action from Hanford.[29] "The operating staff appears to be unconcerned about the hazard," the report concluded.[30] Environmental activists wanted the tanks stabilized in the short-term, and in the long-term, they wanted the waste from these tanks removed and treated, just as was planned for the waste from the double-shell tanks.

What's more, as time went on, environmental activists became impatient with the pace of cleanup progress. Hanford needed to move out of the "study phase" and begin actually to clean things up, they argued.

III.A.2. Concerns of the regulators. Under the TPA, DOE was required to request a budget allocation sufficient to meet the obligations of the agreement. If, however, Congress failed to appropriate sufficient funds to comply with the TPA, DOE-RL would not be expected to meet all its milestones.[31] Within the first two years of implementing the agreement, however, Smith says DOE-RL came to the regulators and argued that they had not been allocated sufficient funds to complete all the scheduled Remedial Investigation and Feasibility Studies (RIFS). DOE-RL administrators argued that they needed about $20 million to conduct each RIFS. Based on their experience at other Superfund sites, the EPA regulators thought these costs were way out of line. DOE-RL and its contractor should be able to do an average RIFS for $3-4 million—maybe $7 million in a particularly complicated case, Smith says. "We would say, 'You don't have a budget problem. You have a cost problem.'"

DOE-RL administrators countered that the EPA and Department of Ecology did not understand how much more expensive the work became when the contamination in question was radioactive and governed not just by CERCLA and RCRA, but also by a complex array of internal DOE orders. The regulators were unconvinced. In 1990-91, EPA and the state Department of Ecology conducted a study to compare the costs of DOE-RL's contractors with those of other private contractors doing similar work—including tasks that did not involve working with radioactivity. "They were charging as much as 400 percent more than our contractors charge us," says Smith.

III.A.3. Concerns of DOE-HQ. For its part, DOE-HQ wanted to revise the schedule for constructing Hanford's high-level waste vitrification plant. Nationwide, DOE was planning to build three such plants. They were complicated and expensive, as they had to be operated entirely by remote control, and the DOE-HQ had decided to stage their design and construction in order to learn from experience. The first vitrification plant was under construction at the Savannah River site, the second was to be built at Hanford, and the third, at the Idaho National Engineering Laboratory (INEL). By

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29 When DOE-HQ learned of this latest, alarming discovery, a team from headquarters, armed with consultants, descended upon Hanford to address the problem. This ruffled feathers at DOE-RL, where engineers argued the chance of explosion was really quite remote. In the end, the problem was resolved by inserting a pump into the tank; by constantly turning over the waste, the pump prevented a build-up of hydrogen gas. The DOE-HQ approach to the problem was "definitely a message to Hanford to get its act together," says one DOE-RL project manager. "Which it deserved."

30 *Washington Post*, August 1, 1990.

31 EPA agreed to this provision, but the state Department of Ecology did not.

1990, however, the Savannah River plant was significantly behind schedule and over budget, with unresolved technical problems. DOE-HQ was therefore reluctant to begin work on the Hanford plant.

III.A.4. Renegotiating the TPA. In March 1993, the DOE, EPA, and the Department of Ecology began six months of negotiations to revise the TPA. The new version—completed in September 1993—differed from the old in several important respects. Under the new plan, DOE-RL negotiators agreed to fully retrieve and treat waste from the single-shell tanks. They agreed to convert their low-level waste to glass rather than grout. They agreed to build waste water treatment facilities and halt waste water discharges to the soil. They agreed to move the eight reactor cores from the banks of the Columbia River to the center of the site and to clean up residual wastes there. They agreed to clean up and release 40 percent of the site—contaminated mildly and only with non-radioactive waste—to public use by the end of 1994. In a side agreement to the TPA, DOE-RL also agreed to undertake a cost-reduction program of $1 billion over a five-year period.

At the same time, DOE-RL won tacit agreement for the idea that an area at the center of the site—the most contaminated portion of the Hanford reservation—would never be cleaned up entirely. And the DOE-RL received substantial delays in deadlines for key aspects of the cleanup. The overall cleanup was to take 40—not 30—years under the new TPA. Construction of the vitrification plant for high-level waste postponed.

III.B. The public participation question

No longer shielded from public scrutiny by the protection of being a "national security" operation, DOE-RL had to figure out what to do about its activist critics and how to contend with the fact that Hanford was generally held in low public esteem. Press reports critical of Hanford continued to appear, even as the defense mission wound to a close and the cleanup took center stage. In the summer of 1990, for example, just after Michael Lawrence's resignation as site manager in June, a "Tiger Team" from DOE-HQ released findings of many violations of health, safety, and management practices at the site. The advisory committee to Watkins revealed that a number of Hanford's single-shell tanks posed a serious explosion risk in the same period. And DOE released the initial estimates of radiation contamination to nearby residents of Hanford during its early years of operation. The study indicated that tens of thousands of people had been exposed to dangerous levels of radioactive iodine.[32] In August, two groups of local residents with health afflictions filed federal class action suits against several of Hanford's early contractors. (DOE, as a federal agency, was itself immune to the suit.) In the early 1990s, the sociology department of Washington State University conducted a telephone survey of several hundred people living in Washington, Oregon, and Idaho, and discovered that in

32 Final results of the study, released in 1994, concluded that during the first decade of the Cold War, half of the 800,000 people living in a 75 mile square mile "danger zone" probably absorbed one rad of I-131 and about 10 percent absorbed 10 rads or more. (One rad was deemed safe, but two rads or more were considered hazardous enough to warrant evacuation.) In the area immediately east and downwind of Hanford, scientists projected that some children might have absorbed 870 rads between 1944 and 1951, and adults, as many as 350 rads. Even some residents of Spokane, 130 miles northeast of Hanford, may have absorbed 44 rads, according to the study. The companion study by the CDC assessing thyroid disorders in the area was not due for completion until 1996. (International Herald Tribune, April 23, 1994 and New York Times, April 22, 1994)

terms of public trust, the Department of Ecology ranked higher than the EPA. Trust for DOE was lower than for EPA, and trust for Hanford's chief contractor—Westinghouse Hanford—was lowest of the four.

In this context, DOE-RL had to decide how to handle increasing public demands for information and for a role in decision-making about the cleanup. In fact, there was already a precedent for some public involvement. As early as 1983, DOE-RL Site Manager Lawrence had taken the step of creating a citizens forum—a cross section of interested citizens—to review DOE-RL's early disposal plans for assorted kinds of radioactive waste in the context of developing the Hanford Defense Waste Environmental Impact Statement.

Lawrence's initiative was not uniformly embraced at Hanford, where many engineers and managers argued that nuclear waste disposal was too complicated for the public to understand. This perception was underscored by press reports that many Hanford employees found muddled and distorted. "I would pick up the paper, I'd read something about Hanford, and I'd say, 'This guy's an idiot. This guy doesn't have a *clue* what's going on here,'" recalls one Hanford engineer.

To involve the public in actual decision-making about nuclear waste disposal struck many engineers as a poor idea. They felt that "many of the decisions would not be technical decisions. They would be based on people's gut reactions. That's where the frustration comes in for many technical folks at Hanford, I believe," says one Hanford manager.

> You have a lot of good scientists and engineers out here. Engineers—they're trained to say, "OK, you want me to do a certain thing. Define the end state. Then I can do the engineering and get you there. Is cost an issue with you? OK, you give me a cost constraint and I'll tell you what I can do to get there within the cost. You just tell me all the constraints, and I'll go do it for you. Just get out of my way." [With the public involved,] the solution that gets picked may not be the most cost-effective, may not be the best engineering solution.

Nonetheless, by the early 1990s, the idea of public involvement had gained considerable acceptance at Hanford, and some DOE-RL and Westinghouse managers championed the idea, as did some administrators at the EPA and state Department of Ecology.

From the vantage point of some DOE-RL administrators, a public advisory group might help DOE-RL and its regulators address the "how clean is clean" dilemma, an issue the TPA had skirted. Left to their own devices, Izatt feared the regulators might push a strict "green fields" agenda for the cleanup which he feared would paralyze the effort.

> I started thinking that we're never going to get anything from the regulator except [a mandate] to clean up every last atom and every last molecule—go to green field—because that's the no-risk position for a regulator. If you say, "Well, gee, it costs too much," [they'll say], "We don't care." [It's like] teenagers with a credit card. They don't have to feel any obligation for

> the fact that it costs you a fortune. They want it and you're paying for it, and that's the attitude.

DOE-RL, meanwhile, wanted to introduce another element into the cleanup discussions: how the 560 square miles of land at Hanford were to be used in the future. "If it's going to be a day care center, well then let's clean it up," he says. "If it's going to sit out there and never be used for anything, maybe a cap and cover is good enough." Thus, Izatt and others, inside and outside DOE, began to advocate the creation of a broadly representative public working group to address two broad questions: how they'd like to see the site used in the future, and what cleanup priorities for the site should therefore be.

Some participants in the cleanup saw a broad political advantage to creating such a citizen advisory group as well. Though Congress was focused on the cleanup in the early 1990s and willing to allocate considerable resources to it, this interest would likely wane, and it would be good to have regional political backing for the cleanup, they reasoned.

In 1992, therefore, DOE-RL, EPA, and the Department of Ecology created the Hanford Future Site Uses Working Group. The group had 28 members, each representing an organization with an interest in the Hanford site. Included were environmentalists, members of state and county government representatives, business interests and tribal representatives.[33] "It did exactly what we hoped it'd do," Izatt says. Over the course of several meetings in 1992, the group came up with some basic priorities—for example, to clean up the areas near the river first—partly because the area was attractive and easily accessible to the public, and partly because it was the part of the site nearest the ground water. While many in the group held out the hope that the entire site would one day be cleaned up, they advised that for the short-term, at least, waste and stored materials should be moved to the center of the site—a plateau several hundred feet above the ground water. Izatt was impressed that the group focused more on actual pollution hazards than on cosmetic improvements. "We got a good strategy," he says.

Building on the success of the Hanford Future Site Uses Working Group, DOE-RL and its regulators convened a group called the Tank Waste Task Force in May 1993 to provide input into the 1993 revisions of the TPA. The group of 27 represented roughly the same set of interests as those in the future site group. Half of the individual members of the task force, in fact, were holdovers from the first group.

In a side agreement to the 1993 TPA, the negotiators created a permanent vehicle for public monitoring of the cleanup, the Hanford Advisory Board. With 33 seats, the basic membership of the board was very similar to that of both the Tank Waste Task Force and the Hanford Future Site Uses Working Group. With alternates included, some 65 to 100 members participated on the board altogether. (The alternates worked on committees, even when they were not formally seated on the board.) As part of a national initiative to include the public in planning of Superfund cleanups at federal facilities across the country, other DOE sites across the country also created citizen boards to

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33 The confederated tribes of the Umatilla Reservation had lost control over the Hanford site in an 1855 treaty, but the treaty had guaranteed the Native Americans hunting and fishing access to undeveloped lands, including those at Hanford.

oversee the progress, but the Hanford group was different in two respects. It had a large budget—approximately $1 million in its first year—which allowed it to do some of its own scientific analysis. At least half the board members—and more, depending how they were counted—were from across the state rather than from the immediate area, a fact that drew praise for inclusiveness from some quarters and criticism from some local participants, who complained that environmentalists from outside the area were overrepresented.

III.C. Contract reform at Hanford

Nationwide—responding to criticism that the DOE contractors as a whole were overspending and underperforming—DOE-HQ began a campaign of changing the contractual groundrules at all its sites in 1993. The contracts had long been operated on a cost-plus-award-fee basis. Critics argued that these contracts—with their full reimbursement for costs, poorly defined criteria for receiving bonuses, and legal liability for mistakes—tended to provide no incentives for working aggressively or containing costs, and to provide a strong incentive for avoiding mistakes.

In addition, the lines between DOE-RL and the contractors tended to blur, partly because DOE-RL had traditionally had collegial relations with its contractors. The semi-annual performance reviews were often a pro forma affair; DOE-RL's Izatt says that in the entire history of the DOE, he recalls only two instances in which the Hanford contractor—be it DuPont, General Electric, Rockwell, or Westinghouse—did not receive a bonus.

"What is called a 'contractor' here has, for all these years, been an organization in which people come, they join the organization, they work in government-owned facilities," says one local observer.

> They're subject to a million government rules. They have a stable career. They traditionally had a lot of job security. The upper management of the contractor comes and goes and the contract gets re-bid, but that only effects the top few hundred people. Most of the many thousands of people think of themselves as Hanford workers. They've come and they've made a career. They don't compete in any marketplace.

In keeping with new DOE philosophy, DOE-RL negotiated a contract with Westinghouse Hanford in 1994, signed in January 1995, with 26 specific performance objectives and with expected dates of completion assigned to each task. Under the contract, Westinghouse could make extra money by beating a deadline, and had to pay money back to DOE if it missed a deadline. On the other hand, DOE-RL included steep financial penalties for major accidents in an effort to deter slipshod work.

Managers at Westinghouse tended to be enthusiastic about the new contract. By comparison to the old system, the new one was clearer and less subjective, providing the contractor with concrete ways to maximize profits, according to William Alumkal, Westinghouse vice president for tank waste remediation systems. Some DOE-HQ administrators believed the new contract made it too easy for Westinghouse to get bonuses, however. This, suggested or e DOE-HQ official, was because it was often

difficult to find a quantifiable measure that truly reflected performance. For instance, "lost work days" might be used as a proxy for appraising the safety of operations, but was too narrow to capture the company's overall safety performance. Due to the narrowness of the performance measures, he contended, Westinghouse could win bonuses without achieving overall good performance.

IV. TWO MAJOR AREAS OF CONTENTION

IV.A: Regulatory burdens vs. compliance overkill

In April 1994, a Seattle reporter tracked down the regulatory hurdles confronting DOE-RL before it could build its high-level waste vitrification plant—a list that included a federal environmental impact statement, a state environmental impact statement, a permit under RCRA for waste and recycling, a nuclear safety review, an operations readiness review, approval by the Defense Nuclear Facilities Safety Board, a safety analysis report, air quality permits, an environmental impact statement with regard to ground water, and, perhaps, a Superfund report on the plant's impact on nearby polluted sites. [34]

Many DOE-RL managers believed that in its first five years—and especially in its first one or two years—the Hanford cleanup had been hog-tied and hamstrung by a litany of regulatory demands. In the early days of the cleanup, Izatt says, state regulators had operated in a hidebound fashion, even on small matters. For instance, one RCRA regulation required stickers and labels on the sides of waste storage tanks. "Our tanks are buried under the ground," says Izatt. "They're covered with dirt and concrete. There's no way we're going to go stick a label on there, so you get in a situation where they keep telling you you're in violation of the following section. Well, the answer is, so what? We offered a couple of times, 'Here, we'll give you the sticker. *You* go stick it on.'"

"There was a lot in the beginning that Hanford was being asked to do that nobody else in the state was being asked to do," Izatt continues. "Because, one, we probably had deep pockets in their view. Two, we needed to pay for some past sins. Three, the [regulators] didn't really know very much about mixed waste."

A classic example of the latter, Izatt says, was the dilemma about how to handle plutonium contaminated PCBs (polychlorinated byphenyls). "One set of rules tells you when you have plutonium, you're supposed to bury it in the ground. [But] the Toxic Substance Control Act says you're supposed to burn PCBs. So you're in a situation of trying to do what's right, but there isn't any 'what's right,' because one tells you to bury it and never burn it and the other tells you to burn it and never bury it.... Now you're stuck. It's illegal to store PCBs, but you've *got* to store them."

Silver of the state's Department of Ecology admitted that some state regulators had been overzealous at times, but said the greater problem was that DOE-RL and Westinghouse Hanford managers tended to go way overboard to comply with RCRA and CERCLA—then blamed the regulators for being unreasonable. It was not hard to fathom the reasons for the overkill, he added. Such episodes as the 1989 raid at DOE's Rocky Flats site had left DOE-RL managers and their contractors concerned

34 *Seattle Times*; April 26, 1994.

that they might face criminal indictment. What's more, in response to serious criticisms of the operational and environmental safety of DOE's field sites in the late 1980s, Energy Secretary Watkins had dispatched Tiger Teams to every site, which had gone searching for all the ways DOE field offices did and did not adhere to the agency's extensive and complicated internal regulations. Throughout the complex, DOE employees were pressed to cross every "t," dot every "i," and avoid mistakes at all costs. What counted as a mistake might be something purely bureaucratic—for example, "being found by an auditor in noncompliance with page 32, paragraph 14A of some regulation," says the EPA's Smith. "That was a no-no, and people would talk about 'career-limiting events.'"

In the *minds* of some close observers, the tendency toward compliance-overkill was partly the result of a modus operandi left over from the days of plutonium production, when cost was no object and mistakes were unthinkable. "In nuclear bomb-making, everything has to be perfect. Every detail: The blue valve has to be opened 2.5, not 2.75, turns. But in environmental cleanup, it doesn't work that way," says Paul Day, a former EPA regulator and present consultant for the Hanford site:

> You fly by the seat of your pants a lot of the time. It's a *different* ball game, and it doesn't take the same precision. For example, the tank farms. You have to back up and say, wait a minute. *It's just waste.* It's hot waste, and it's nasty waste, and it's very deadly waste, but it's just waste, and we really only have to know enough about that waste to safely retrieve it, store it, treat it, and dispose of it. We're not going to make toys out of it or something. You don't have to have so much up-front information, so much planning, so much caretaking as you would, say, with a nuclear reactor, where you're worried about a meltdown situation if something goes wrong, or a criticality.

In a different vein, the EPA's Smith argues that the common practice of hiring private consultants to spell out what needed to be done to comply with the environmental laws also contributed to the compliance-overkill. Such consultants tended to "spend a lot of money to read through every conceivable EPA guidance, every conceivable EPA rule, and they come back and say, 'If you want to be safe, do this,'" says Smith. DOE-RL managers would then tally up the cost of implementing the consultant's recommendation—often exorbitant—"and then turn around and say, 'This must be a stupid set of regulations,'" Smith adds. The problem, he continues, is that "it's in the consultants' interest to be gold-plated: they might get hired to carry out the work."[35]

Even when Hanford managers received specific assurances on a point from the regulators, they took an overly cautious approach, according to one insider. "They say, 'Oh, well, that might be how *they* interpret it, but we could get new regulators, and you never can tell. We better do it this other way.'"

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35 Westinghouse's Rick Wojtasek says this characterization is "far from the truth," however, arguing that, in fact, DOE-RL and Westinghouse had taken the lead to expedite the assessment phase for some of the old waste sites, especially those along the Columbia River, and met considerable resistance from the EPA.

DOE-RL managers and their regulators all agreed that the most onerous and least sensible regulations they had to contend with were DOE's own management and operations protocols, handed down from Headquarters. "The department is very reluctant to grant waivers to its own requirements," says the DOE-RL's James Mecca. "But in some cases, they don't make sense."

"Those orders were, in effect, the central administration's way of re-enforcing this culture of 'be very safe and be very slow and be very careful,' and they were designed for an operating system using nuclear materials," echoes the EPA's Smith. "In our view, many, many of the DOE orders are completely irrelevant. Those that are not irrelevant are often gold-plated. We've been asking for several years for those orders to be reformed—for someone to go in with a meat ax and just start whacking away at them. That hasn't happened yet."[36]

The combination of regulatory overkill and the aversion to making mistakes was so entrenched at Hanford that it created a strong disincentive to take any action at all on the actual cleanup, Day says. "The sooner I take action, logically, the more chance there is for a failure. And there's a point in there—you shouldn't be rambunctious either. But we don't seem to be getting to the go-do-it phase, because people have no incentive to take a risk. If there is a failure, there is, I believe, still retribution within the DOE system—whether it's DOE or its contractors."

IV.B. Contentious relations between DOE-RL and DOE-HQ

Another source of frustration for DOE-RL and Westinghouse managers had to do with the relationship between DOE-HQ and DOE-RL . The two branches of DOE had trouble agreeing on a plan of action and there was perpetual uncertainty over which branch of the agency was truly running the show.

IV.B.1. The new de-centralization. In 1993, when Bill Clinton became President of the United States and appointed Hazel O'Leary as Secretary of Energy, the DOE-HQ had gone through another change in management philosophy. In direct contrast to her predecessor, Admiral Watkins, O'Leary believed in the concepts of decentralization and matrix management. In certain respects, authority was once again delegated to the sites. Thus, for example, some documents and reports that had required approval from Headquarters under the Watkins Administration could be approved at the site office under O'Leary.

What's more, under the new system, DOE-RL, like the other field offices, sent its entire Environmental Management budget directly to DOE Assistant Secretary Thomas Grumbly. In the past, the different divisions of DOE-RL's Environmental Management program—Waste Management, Environmental Restoration, Facility Transition and Technology Development—had sent their budget requests "up the stove pipe" to their counterpart divisions in Headquarters. The DOE-HQ staff would review these budgets and pass them along to Grumbly with their own recommendations. Under the new system, the DOE-HQ program managers were cut out of the loop. Budgetary tradeoffs were weighed and decided at "a high level," according to one DOE-HQ program manager, in a large meeting attended

36 One administrator from DOE Headquarters, however, argued that part of what made the DOE orders so onerous was the conservative way they were interpreted by the site offices.

by all the field office managers. "The Deputy Assistant Secretaries [in Headquarters] used to be on the hot seat," he says. "Now it's the site managers."

Meanwhile, the program managers in Washington DC, brought in under the Watkins administration, were still in place, and it became unclear to everyone what, exactly, their authority was vis-a-vis the field staff. In theory, they were expected to set broad goals for the field staff, rather than becoming involved in day-to-day operations. But that distinction was clearer on paper than in reality.

IV.B.2. Contention over the Tri-Party Agreement. One critical source of tension between DOE-HQ and DOE-RL concerned Hanford's TPA. Senior managers at DOE-RL worried that DOE-HQ would not do its part to support their TPA. From the perspective of DOE-RL, "doing its part" meant supplying adequate funds, providing timely approvals, and declining to second-guess the specific remedies outlined in the plan.

From the perspective of DOE-HQ, however, the TPA was but one of a number of considerations. Nor was it set in stone; by 1995, the agreement had been amended some 170 times with regulator approval. In fact, the TPA—along with 100 other similar agreements drawn up around the country—threw certain federal-vs.-regional control issues into relief. According to the projections of DOE-HQ, the cost of fully funding the agreements drawn up between the DOE field offices and their regulators all across the country was exorbitant and would never win the approval of Congress, which was, by the mid 1990s, interested in shrinking the cleanup budgets. At the national level, in fact, DOE-HQ was criticized for having entered into these agreements at all. "In many cases, the DOE has tied its own hands by signing legal agreements with states and other federal agencies which it has neither the money nor the technology to meet. As a result, the department has been left open to a barrage of lawsuits that is usurping federal policy," a Los Angeles Times reporter declared in 1994.[37] DOE-HQ maintained that it had an important role to play in terms of establishing priorities on a national level—and that the TPA and other agreements could not be regarded as immutable. This posture infuriated DOE-RL and its contractor, who noted that personnel from DOE-HQ had been involved in the complex and difficult process of negotiating the TPA, had expressed support for the accord at the highest levels of the agency, and should thus be expected to honor it.

IV.B.1.a. A case study: The pre-treatment controversy. A particular area of contention was that some managers in DOE-HQ wanted DOE-RL and Westinghouse to be willing to explore alternatives to specific technical approaches contained in the agreement. An example of this, which emerged virtually as soon as the 1993 version of the TPA had been completed, was a difference of opinion over the method of "pre-treating" tank waste—that is, separating the high- from low-level wastes. Under the TPA, the parties had agreed to a process of "washing" the wastes in a basic solution. This had the advantage of being a tried-and-true, proven technology. A more advanced kind of sludge washing—more complicated and less well proven—involved washing the wastes in an acidic solution. If successful, federal officials believed the acidic wash would significantly reduce the volume of high-level waste.

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37 *Los Angeles Times*, November 27, 1994.

To DOE-HQ, this was an important matter. Project managers in Washington worried that the federal waste repository at Yucca Mountain, Nevada would not be big enough to hold all the vitrified high-level waste Hanford was likely to churn out. Michael Gates, DOE-HQ's acting deputy office director of Hanford waste management operations, estimated that, under the pre-treatment scheme favored by DOE-RL, Hanford could produce as many as 100,000 glass logs of high-level waste. The repository had room only for 10-12,000 logs from Hanford, he added. DOE-RL officials disputed the estimate, arguing that their pre-treatment approach would do a better job of reducing the volume of high-level waste than the federal projections indicated. They wanted to proceed on that assumption unless proven wrong. "They're saying [the basic] sludge washing will do it," says Gates. "Well, what if it doesn't? [DOE-RL says, 'If it doesn't work,] then we'll stop and figure it out.' [But we say,] 'Well, why don't you invest some effort now in more advanced pre-treatment?'"

The dispute threw into relief a larger philosophical difference between the DOE-HQ and DOE-RL offices. "Our key word is 'robustness,'" says Gates.

> Yeah, we agreed to this path in the TPA, but why aren't we looking at alternatives, to make sure that's the best path, and to also foresee potential road blocks ahead? If we can show a path that gets us there in the same time and does as good a job or better—the regulators will agree to it. But for a number of reasons, the Richland office does not evaluate alternatives. They've picked a path, and they're doing it. They cite budget constraints, which are real, but there is also, from our standpoint, some evidence that they're not trying to do it either.

From the perspective of the DOE-RL managers, however, the pre-treatment controversy revealed a basic unwillingness on the part of the headquarters office to commit to any concrete decision, even when—as in the case of commitments in the TPA—the Headquarters administrators had been involved in the TPA negotiations and had voiced support for the accord. "I don't have agreement, apparently, with DOE-HQ that they agreed to the TPA at all," says Westinghouse's Wojtasek.

> It's like, "Oh, yeah, so we agreed, but we didn't *really agree*." So you sit there and you grab your head and you say, "We just spent two years negotiating this thing with the regulators and the public—excruciating years—and now you don't like the technical approach?" Every decision gets pulled back up to the top and gets hammered in this whole, "Is it the right technical solution? Are we going down the right path? Gee, do we *really agree*?"... We're constantly revisiting our decisions, and as a result, we're not really making decisions.

In fact, some of the DOE-RL managers believed that there were strong systemic disincentives in play that discouraged the DOE-HQ staff from agreeing to any substantive action on the cleanup. For

one, beginning a major piece of the cleanup—building a pre-treatment facility or a vitrification plant for the tank wastes, for instance—would involve a tremendous initial capital outlay, likely to be unpopular in Congress. What's more, to begin a project was to risk something going wrong—perhaps something big enough to end a bureaucrat's career. Says Wojtasek, "Under Admiral Watkins, he ran it as a Navy, and we ended up in a zero-risk mentality. The Clinton Administration is saying, 'Well, look, we're willing to take some risk.' [But] everybody who was there under Watkins is still there under O'Leary. O'Leary can say, 'Yeah, I'm willing to take some risk.' And Grumbly can say it. You might even get that from their next layer. From there on down, it's that frozen layer of bureaucracy where [the attitude is,] 'Hah! I know what they said, but come on. I'm going to be here in four years. They're not.'

> Headquarters is trying to survive politically. They use technical uncertainty to help them delay decision-making: "I don't have all the answers. I need all the answers. *All* the answers. I need all this data before I can make a decision." And there's never enough to satisfy them.

For his part, DOE-HQ's Gates denied that DOE Headquarters was deliberately holding up cleanup progress. He argued that it was possible—and essential—to move forward and to be prepared for changes in direction at the same time. "Some people get really hung up that things change—and I can see it, too. They're focused on building this certain building to do a very good thing. But, well, something changes nationally, and that isn't as high a priority. Or a law changes, and it has to be done another way. They have to change. You just have to have a system that can change in a rational manner."

V. ON THE HORIZON: THE BUDGET CRUNCH

By early 1995, DOE as a whole had become an embattled agency. The zealous freshman Republican legislators elected to the House in 1994 had proposed eliminating the agency altogether. Energy Secretary O'Leary headed off this draconian move with a promise to slash the agency budget—$17.5 billion in 1995—by $14 billion over the next five years. Some $4.4 billion of that reduction was expected to come from the Environmental Management program, which accounted for nearly a third of the DOE budget.

In early 1995, the senior managers at Hanford were still not sure how big a budget reduction they would have to absorb. "We expect to go down about 38 percent on work we have to do," said Izatt in January 1995. In order to accommodate this reduction without abandoning the TPA, administrators in DOE-RL decided to hold off on announcing that they would have to miss the "milestones" laid out in the agreement and instead go back to the drawing boards and try to save money internally. They called this approach a "productivity challenge," but Izatt concedes, "That's way too high for a productivity challenge. Five to ten percent, I could live with. It becomes a euphemism for, 'We're not giving you the money, but it's your responsibility to comply with the requirements.'"

Back in Washington State, the anticipated budget cuts catapulted DOE-RL managers, regulators, and citizen activists into heated discussions about the fate of the painstakingly re-negotiated TPA. O'Leary and her staff at DOE Headquarters made it clear that compliance agreements would not drive either the agenda or the budget of the DOE. On the one hand, DOE-RL managers insisted to the Washington office that the DOE must provide sufficient funds for the TPA; DOE had already committed to the agreement, they argued, and it was legally binding. On the other hand, DOE-RL managers argued to their regulators and citizen advisory board that, if they received major funding cuts, they could not be held to all the milestones in the agreement.

Such statements set off alarm bells for the regulators and advisory board members who worried that, faced with budget cuts, the DOE-RL managers would dismantle some of the delicate compromises in the TPA and "preserve the things that are most important to [themselves]," says Smith.

> Decisions at the site here are a product of the process of negotiation of the public and people at the site about how to balance relative priorities in the cleanup. When you get done with that, I think it represents pretty good wisdom. Separately, you've got a national budget-making process where people have to weigh and balance big categories of objectives and say, "We want more of this and less of that." The two don't link. It just produces this big disconnect. And I think it's a powerfully large problem.

At the same time, regulators and advisory board members believed that Hanford was so excessively funded that the site should be able to sustain even major budget cuts and still comply with the agreement. "In my opinion—and most of our staff's—the budgets paid for environmental restoration and waste management have been close to a third larger than they need to be in order to get the job done," says Silver of the state Department of Ecology:

> The site has not been managed for cost. The greatest values have been, first, safety. [Since 1989,] the site has been managed so that nobody makes a mistakes. Layers of redundancy to get controls and ensure no mistakes. They don't want to show up in the newspaper. The second value they manage for at the site—if I can just call it "relations." Relations between Energy and the people of the state were terrible. There was no trust or credibility.
>
> They've been relatively successful in both of those values. It is a much safer place than it was six years ago. The industrial accident rate has dropped. The tanks are not going to explode. They paid hundreds of millions of dollars for that. And they've done a very good job at relations with the state,

environmental groups, the tribes. Even the most vocal critics of Energy would say it's much better than it was six years ago.

The next frontier for DOE-RL, Silver adds, is to focus on "environmental value-return for dollar of cost."